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Resources

ONTARIO GEOLOGICAL SURVEY
Open File Report 5433

Sand and Gravel Assessment for the United Counties of Prescott and Russell

1983

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Ministry of Natural Resources
Ontario

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Sand and Gravel Assessment for the United Counties of Prescott and Russell

by

G.A. Gorrell and T.W. Fletcher

1983

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E.G. Pye, Director
Ontario Geological Survey

FOREWORD

This report presents an inventory of sand and gravel resources in the United Counties of Prescott and Russell. Sand and gravel, and particularly aggregate for high-specification uses, are in limited supply in the United Counties. The maps accompanying this report delineate the areas of the best sand and gravel reserves. This information is presented so that land use planning strategies will allow the fullest use of these valuable resources.

E.G. Pye, Director
Ontario Geological Survey

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SUMMARY

There are only minor reserves of sand and gravel within the United Counties of Prescott and Russell.

The work that has been done indicates that there are only 9.06 million cubic metres of usable sand and gravel within the United Counties. West Hawkesbury Township not only has over 42 percent of all the available material, but also all the high quality aggregates (i.e. material classified as "1" and "2" under the F.K. system).

The rest of the townships are virtually devoid of sand and gravel. The high quality material must be either derived from Paleozoic bedrock sources or hauled in from adjacent Counties or the Province of Quebec.

SAND AND GRAVEL ASSESSMENT

FOR THE

UNITED COUNTIES OF
PRESCOTT AND RUSSELL

BY

G. A. GORRELL[1] AND T. W. FLETCHER[2]

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Figure 1 - Location Map

INTRODUCTION

In the strictest sense, a resource is any supply that will meet a need. Natural resources, such as aggregates are representatives of the actual and potential wealth of an area. Within any area, there are discrepancies between the perceived, actual, and potential resources. These factors should be recognized before any classification is attempted.

The physical description of a resource is derived and controlled by a set of quality restrictions that are established as construction criteria by Government agencies. These specifications can be altered depending on the material available, but still stay within established requirements.

Beyond the physical description of a resource are intangibles which affect the actual resource classification. Man-made features such as railways, hydro lines, roads, and village locations will alter any resource classification. If the potential resource, aggregates in this case, is under a road or railway line, it cannot, without moving the road or railway, be classified as an actual aggregate resource. The material has become part of the developed landscape and because it can no longer be extracted, it is no longer a viable resource.

The Ministry of Natural Resources, Eastern Region, has assessed the aggregate resources of the United Counties of Prescott and Russell. The actual physical specifications or usefulness of the aggregate resource is a manifestation of many variables. Factors such as the sterilization of resources and depletion of the available material are regarded as important variables. The final assessment is designed to illustrate the location of potentially workable aggregate deposits and to assist the United Counties, or municipalities, and industry in planning for aggregate conservation and extraction.

RECOMMENDATIONS

(1) There is an acute shortage of natural sand and gravel within the United Counties of Prescott and Russell. Only West Hawkesbury Township has any appreciable high quality sand and gravel reserves. The high quality deposits should be allowed to be extracted to their maximum potential.

(2) All areas of sand and gravel designated 1, 2, and 3 that have not been sterilized, should be protected for future use.

(3) Testing on the fine deltaic sands has indicated that there are small pockets of 2(b) and 3(b) material within the sand deposits. Those are shown on the accompanying maps. These are site specific features not indicative of all the sands. These areas, like the other high quality aggregate deposits, should be extracted to their fullest potential.

(4) There is an abundance of granular fill in the form of deltaic sand deposits. Extracting in these areas for fill should continue so that the high quality deposits can be used where higher specifications are called for. Extraction should be permitted under the Rural Category.

(5) High quality aggregate is in great demand within the study area. This material, especially the high quality sand, should be protected because the manufacture of sand from bedrock is very expensive.

GEOLOGICAL SETTING

Studies done on the area have found no remnants of pre-Wisconsinan glacial events. From the Wisconsinan period though, six surficial units have been identified: (1) till, (2) clay, (3) silty fine sand, (4) sandy clay, (5) wave-washed sand and gravels, and (6) partially buried glaciofluvial ridges.

The first four units have the greatest areal extent within the United Counties. The till, which correlates with the Fort Covington till in the Cornwall area (Gwyn and Lohse 1973) indicates that the most recent ice advance was from the northwest.

When the Fort Covington ice margin retreated, the marine waters, which had to that time been blocked by the ice, inundated the area creating the Champlain Sea.

The drainage of fresh water into the sea from the Pembroke area and the uplift of land limited the westward extension of the Champlain Sea. Continued drainage and uplift gradually transformed the marine environment to a freshwater environment.

The Champlain Sea was responsible for many of the surficial units in the area. Concerning sand and gravel deposits, the predominant units are the wave-washed sands and gravels. These ancient beach ridges are found at elevations ranging from 76 to 120 metres and are derived from the surrounding till. The ancient beach ridge south of Vankleek Hill is the largest sand and gravel ridge within the United Counties.

The drainage of fresh water from the Pembroke area into the Champlain Sea formed a large delta extending as far as Hawkesbury. The silty fine sands of the delta have very few uses.

The only other notable sand and gravel deposits are buried glaciofluvial ridges. Investigation indicates that three such ridges are found within the study area: (1) east of Howkesbury, (2) east of Embrun, and (3) on the Dundas County and Russell County border. Testing and past extraction have indicated that a minimum of six metres of materials remain below the

water table. The lack of glaciofluvial ridges indicates that the ice retreated rapidly from the study area (Gwyn and Thibault 1975).

FIELD PROGRAM

A six-stage field program was carried out in 1978, 1979, and 1980. The initial step, in 1978, was the reconnaissance of the area where all the pits and quarries were found, described, sketched, and mapped. The information obtained was used to estimate the amount of material removed. This information provided a firm base for the final assessment.

An intensive field program was carried out in 1979 and 1980. A literature search of previous work on the surficial geology was carried out. Studies by Fraser (1976), Richard (1970;1975), Owen (1951), Sharpe (1979), Terasmae (1965), MacClintock (1958), Chapman and Putman (1966), Charron (1978), Gwyn and Thibault (1975), Gwyn and Girard (1975), Gwyn and Lohse (1973), Wagner (1970) and Proctor and Redfern (1975) were studied and the pertinent data was transferred to 1:50,000 scale topographic maps.

Black and white aerial photographs with approximate scales of 1:50,000, 1:37,000, and 1:15,000 (taken from flights flown in 1971, 1976, and 1978 respectively) were examined and features with sand and gravel potential were also transferred to the 1:50,000 topographic maps. General depths for the sand and gravel deposits were established from Ontario Ministry of the Environment (MOE) well log records and marked on the corresponding deposits. Detailed field checks followed where the suitability and the extent of each deposit were established.

The field investigations are extensive and interrelated with previous work. As each deposit and/or pit was checked, the aerial photographs were re-examined to find trends. This continuous re-evaluation established tentative cut-offs or economical limits for each deposit. The investigations noted the sand/gravel ratio, grain size of the sands present, silt and clay content, the amount of deleterious material (shale, siltstone, etc.); and the extent of the sterilization and depletion of the material. The information gathered was the basis for the adjustment of the dimensions of the deposits which had been established from previous work. Vertical and horizontal dimensions were determined by seismograph, EM-31 terrain conductivity unit and truck

mounted power augers. From this data, tentative economic boundaries of the deposits were established.

Deposits which were less than one metre deep, unless they were of great areal extent, and aggregate resources 10 metres below the water table and deeper were considered as uneconomical and discounted as a regional resource. Some of the shallow deposits, however, have been noted as possible resources for local use only.

PALEOZOIC (Paleozoic Bedrock)

No townships within the United Counties of Prescott and Russell have substantial natural sand and gravel reserves. Either because of the lack of material, or because of development on the sand and gravel deposits, there are only minor amounts of material available. If future demands, 12.6 tonnes per capita/year (Proctor & Redfern 1975), within the United Counties are to be met at minimum cost, the bedrock resources eventually will have to be utilized.

RESERVE CALCULATIONS

The estimation of the usable aggregate within the United Counties of Prescott and Russell was obtained by using the F. K. Classification System. The estimation classification involves the analysis of M.T.C. data, the examination of air photographs and previous reports and an extensive field program for ground truth. This does not provide a guaranteed reserve figure but is realistic, taking into account the local changes in the quality and quantity (i.e., the sterilization and the depletion of the aggregate) of the material. The resultant document is a valuable asset for planners, as it provides a realistic interpretation of the area studied.

The total reserves of the United Counties of Prescott and Russell are given in Table 1. The basic F. K. aggregate classification system is shown below Table 1 to aid in a rapid determination of the type of gravel given in the table.

The reserve figures are derived from the field work. Samples taken from representative areas and later tested were correlated with the field work. The reserve figures are derived from those results.

F.K. AGGREGATE CLASSIFICATION SYSTEM

COARSE (a)	FINE (b)
1. Asphalt & Concrete	Asphalt & Concrete
2. Granular A, 16 MM Crushed	Blending Sands
3. Granular B and C	Granular B and C
4.	Granular Fill

The F.K. Aggregate Classification System, developed by Eastern Region of the Ministry of Natural Resources, groups granular deposits into two gradational categories, coarse and fine aggregate, and four quality categories (1-4), based on the standards of the Ministry of Transportation and Communications (MTC). The percent of material retained on the #4 sieve, determines the coarse aggregate content.

Classification '1a' is coarse aggregate, '1b'is fine aggregate, that is generally acceptable for asphalt and/or concrete uses, (MTC Form 1002, 1003). This is the highest quality aggregate, and should be protected for these purposes.

Classification '2a' includes gravel that, when processed, can meet the quality and gradational standards of the MTC for Granular A and 16 MM Crushed A, B. (MTC Form 1010). A deposit is considered a Granular A source, if it contains a minimum of 35% in coarse aggregate (greater than 5 MM sieve), and a minimum of 20% larger than 25 MM sieve. Minor quality problems prohibit its use for asphalt or concrete uses.

This material is used as a base for asphalt or concrete pavements, as the traffic surface for secondary (gravel) roads or as crushed aggregate for the shoulders of the highway.

Classification '2b' are sands that are blended in small quantities with other sands or quarry screenings (dust), to produce a product that meets the gradational specifications for asphalt or concrete.

Classification '3a', '3b' includes aggregate commonly known as "pit run", which is normally unprocessed sands and gravels. This material is used to build the road base to grade level in preparation for the application of Granular A, (MTC Form 1010).

Classification '4' includes material located within the boundaries of an aggregate deposit, that is suitable for granular fill only. This material is still granular in nature, however, it does not generally meet the above granular specifications.

LIMITATIONS OF STUDY

(1) This classification is based on the ultimate usage of the material. Therefore, economic boundaries have been delineated, not the geological boundaries.
(2) The deposits are classified by the largest proportion of material present.
(3) Some material however, could be beneficiated to meet higher specifications. In this way, more high quality material would be available.
(4) Small pockets of good material, which may occur in areas of inferior material, have not been mapped because of scale.
(5) Quantities reported are probable reserves, not proven reserves, and hence a subject to detailed site specific testing.

TABLE 1

CLASSIFIED AGGREGATE - SAND AND GRAVEL PROBABLE RESERVES

(million cubic metres)

TOWNSHIP	'1a'	'1b'	'2a'	'2b'	'3a'	'3b'	TOTAL
PRESCOTT CO.							
1. Alfred	-	-	-	-	-	-	-
2. Caledonia	-	-	-	-	0.10	-	0.10
3. East Hawkesbury	-	-	-	-	1.03	-	1.03
4. Longueuil	-	-	-	-	0.12	1.24	1.36
5. North Plantagenet	-	-	-	-	0.33	-	0.33
6. South Plantagenet	-	-	-	-	-	-	-
7. West Hawkesbury	1.32	0.50	0.50	-	0.60	0.80	3.72
RUSSELL CO.							
1. Cambridge	-	-	-	-	0.74	-	0.74
2. Clarence	-	-	-	-	-	0.15	0.15
3. Russell	-	-	-	-	1.63	-	1.63
TOTAL	1.32	0.50	0.50	0	4.55	2.19	9.06

F. K. AGGREGATE CLASSIFICATION SYSTEM

Coarse (a)	Fine (b)
1 Asphalt & concrete	Asphalt & concrete
2 Granular A 16mm crushed	Blending sands
3 Granular B and Granular C	Granular B and Granular C

RUSSELL COUNTY

Russell County has an acute lack of natural sand and gravel. There are a few ancient beach ridges, but they represent only a minute amount of material. The majority of the sand and gravel being used has been derived from deltaic deposits. These deposits have only limited uses. While the material in one location passes the requirements for blending sand, it will not pass in an adjacent area. The sands are site specific in nature and any construction activity should recognize this.

The only viable reserves are within the partially buried glaciofluvial deposit in Russell Township. The material has been draglined and testing indicates that two to four metres is above the water table and 10 metres of material is below the water table. The material, however, has a high percentage of shale and can only be used as granular C. Any high quality material has to either be hauled in from adjacent townships or be derived from Paleozoic (bedrock) sources.

CAMBRIDGE TOWNSHIP

Table 2 - Classified Aggregate

CLASSIFICATION	(a) Coarse	(b) Fine	CLASSIFICATION
1 Asphalt and Concrete	-	-	Asphalt & Concrete
2 Granular A & 16mm crushed	-	-	Blending Sands
3 Granular B and Granular C	0.74	-	Granular B & C
4 Granular Fill			Granular Fill

Quantities in cubic metres X 10^6

There are only two areas in Cambridge Township which have usable reserves of sand and gravel. Generically the deposits are partially buried glaciofluvial ridges which have been altered considerably. The construction of Kings Highway number 417 however, has removed much of the material that was on the surface. The material that remains is below the water table and any major future extraction activities will have to dragline or use a similar method to remove the material.

Testing on the material indicates that while some portions are coarse enough to crush, the percentage of poor stone (shale) and silt limit the possible uses. Testing indicates that 740,000 cubic metres of '3a' material remain.

Other possible reserves are the silty fine deltaic sands in the northern portion of the township. Some locations have material which has been tested and passed the specifications required for '2b' and '3b' material. Areas adjacent to the locations will not always pass the specifications required. This lack of continuity is the reason why the material has been classified as '4'.

Table 3 - Classified Aggregate

CLASSIFICATION	(a) Coarse	(b) Fine	CLASSIFICATION
1 Asphalt and Concrete	-	-	Asphalt & Concrete
2 Granular A & 16mm crushed	-	-	Blending Sands
3 Granular B and Granular C	-	0.15	Granular B & C
4 Granular Fill			Granular Fill

Quantities in cubic metres X 10^6

There are only minor reserves of usable sand and gravel within Clarence Township. Generically the material is located within silty, fine deltaic deposits. Testing indicates that although some locations have sands passing the requirements for class '2b' and '3b' material, the majority of the material does not. The sands are generally too fine and uniformly graded for any granular use. Any construction activity should recognize that any usable sand is a site specific occurrence.

There is one ridge where sand meets the gradations required for '3b' material. Testing indicates that 146,000 cubic metres of '3b' material remain.

Table 4 - Classified Aggregate

CLASSIFICATION	(a) Coarse	(b) Fine	CLASSIFICATION
1 Asphalt and Concrete	-	-	Asphalt & Concrete
2 Granular A & 16mm crushed	-	-	Blending Sands
3 Granular B and Granular C	1.63	-	Granular B & C
4 Granular Fill			Granular Fill

Quantities in cubic metres X 10^6

There are only minor amounts of usable sand and gravel in Russell Township. The usable material is found in two ancient beach ridges west of Feldon and a partially buried glaciofluvial deposit on the Russell and Dundas County borders.

The partially buried glaciofluvial deposit has been excavated below the water table. Testing indicates that a large percentage of the material is shale, limiting the possible uses. There is 755,000 cubic metres of '3a' material remaining.

The ancient beach ridges west of Feldon have only limited use. The amount of silt, shale, and boulders present indicates that the sand and gravel passes only the specifications required for '3a' material. Testing indicates that 872,000 cubic metres of material remain.

The only other potential sand and gravel deposit are the deltaic sands in the northeast corner of the township. Testing on these sands indicates that some portions will pass the specifications required for '2b' and '3b' material. The results are not indicative of all the sands. Testing in adjacent areas found that the sand has extremely high percentages of silt and large amounts of oxidized sand. These sands will not pass the specifications required for '2b' or '3b' material. The sands, because they are site specific in nature, have been classed as a '4'.

PRESCOTT COUNTY

Only two townships within Prescott County, East Hawkesbury and West Hawkesbury, have appreciable sand and gravel reserves. Generally, these reserves are located within ancient beach ridges, although there is one partially buried ice-contact deposit. Development and past extraction activities, however, have utilized considerable amounts of available material within these ridges. Testing indicates that relatively small amounts of high quality sand and gravel remain.

The rest of the townships have negligible amounts of usable material. Areally, silty fine deltaic deposits are the most evident. While the sands in one area can pass the requirements needed for class '2b' and '3b' material, sands in adjacent areas will not. The sands, because they are site specific in nature, have been classified as '4'.

ALFRED TOWNSHIP

Table 5 - Classified Aggregate

CLASSIFICATION	(a) Coarse	(b) Fine	CLASSIFICATION
1 Asphalt and Concrete	-	-	Asphalt & Concrete
2 Granular A & 16mm crushed	-	-	Blending Sands
3 Granular B and Granular C	-	-	Granular B & C
4 Granular Fill	-	-	Granular Fill

Quantities in cubic metres X 10^6

All the material mapped in Alfred Township is located within silty, fine sand deltaic deposits. Testing indicates that some areas have small amounts of sand passing the requirements needed for class '2b' and '3b' material. These sands represent only a small proportion of the material tested. The sands are generally too fine and uniformly graded for any granular uses. The sands, because they are site specific, have been classed as '4' material.

Table 6 - Classified Aggregate

CLASSIFICATION	(a) Coarse	(b) Fine	CLASSIFICATION
1 Asphalt and Concrete	-	-	Asphalt & Concrete
2 Granular A & 16mm crushed	-	-	Blending Sands
3 Granular B and Granular C	0.10	-	Granular B & C
4 Granular Fill			Granular Fill

Quantities in cubic metres X 10^6

Caledonia Township has virtually no high quality sand or gravel. The largest deposit is the silty, fine delta in the southern portion of the township. The testing that was done indicates that some '2b' and '3b' material is present. The sands are generally too fine and uniformly graded to be used as anything but fill.

One deposit, a water-washed ridge one kilometre north of McAlpine, contains usable granular material. Testing indicates that 97,000 cubic metres of '3a' material remain.

Table 7 - Classified Aggregate

CLASSIFICATION	(a) Coarse	(b) Fine	CLASSIFICATION
1 Asphalt and Concrete	-	-	Asphalt & Concrete
2 Granular A & 16mm crushed	-	-	Blending Sands
3 Granular B and Granular C	1.03	-	Granular B & C
4 Granular Fill			Granular Fill

Quantities in cubic metres X 10^6

There are only minor reserves of sand and gravel in East Hawkesbury Township. Investigation has found only one deposit, a partially buried ice-contact ridge east of Hawkesbury, which has appreciable reserves. Testing indicates that the ridge extends a minimum of 14 metres below the surrounding and overlying marine silt, sand and clays. Testing indicates that 722,000 cubic metres of '3a' material remain.

There are only two other ridges within East Hawkesbury which have appreciable reserves. Testing indicates that these ancient beach ridges have approximately 302,000 cubic metres of '3a' material remaining.

Table 8 - Classified Aggregate

CLASSIFICATION	(a) Coarse	(b) Fine	CLASSIFICATION
1 Asphalt and Concrete	-	-	Asphalt & Concrete
2 Granular A & 16mm crushed	-	-	Blending Sands
3 Granular B and Granular C	0.12	1.24	Granular B & C
4 Granular Fill			Granular Fill

Quantities in cubic metres X 10^6

There is an acute shortage of natural sand and gravel in Longueuil Township. The largest areal deposit, a wave-altered delta and till complex near Cassburn, has only '3b' material. This deposit has the greatest reserves of usable granular material within the township. Testing indicates that 1,243,000 cubic metres of '3b' material remain.

Only two other small ridges have usable granular material. Testing of these deposits, southwest of Henrys Corners, has indicated that 121,000 cubic metres of '3a' material remain.

Table 9 - Classified Aggregate

CLASSIFICATION	(a) Coarse	(b) Fine	CLASSIFICATION
1 Asphalt and Concrete	-	-	Asphalt & Concrete
2 Granular A & 16mm crushed	-	-	Blending Sands
3 Granular B and Granular C	0.33	-	Granular B & C
4 Granular Fill			Granular Fill

Quantities in cubic metres X 10^6

There is virtually no usable sand and gravel within North Plantagenet Township. Areally the majority of the material is located within silty, fine sand deltaic deposits. The sands are too fine and uniformly graded to have any granular uses. Some areas have been tested and the sands have passed the requirements needed for '2b' and '3b' material. These areas, however, are site specific and represent only a small fraction of the material tested. The sands, because they are site specific in nature, have been classed as '4' material.

The only material which has been tested and passed specifications required for granular uses is located at the Rollway. The deposit, which is probably an altered glaciofluvial deposit, has 330,000 cubic metres of material remaining.

Table 10 - Classified Aggregate

CLASSIFICATION	(a) Coarse	(b) Fine	CLASSIFICATION
1 Asphalt and Concrete	-	-	Asphalt & Concrete
2 Granular A & 16mm crushed	-	-	Blending Sands
3 Granular B and Granular C	-	-	Granular B & C
4 Granular Fill			Granular Fill

Quantities in cubic metres X 10^6

There is virtually no usable sand or gravel within South Plantagenet Township. Areally the majority of the material is located within silty, fine sand deltaic deposits. The sands are too fine and uniformly graded to have any granular uses. Some areas have been tested and the sands have passed the requirements needed for '2b' and '3b' material. These areas, however, are site specific and represent only a small fraction of the material tested. The sands, because they are site specific in nature, have been classed as '4' material.

WEST HAWKESBURY TOWNSHIP

Table 11 - Classified Aggregate

CLASSIFICATION	(a) Coarse	(b) Fine	CLASSIFICATION
1 Asphalt and Concrete	1.32	0.50	Asphalt & Concrete
2 Granular A & 16mm crushed	0.50	-	Blending Sands
3 Granular B and Granular C	0.60	0.80	Granular B & C
4 Granular Fill			Granular Fill

Quantities in cubic metres X 10^6

West Hawkesbury has the greatest amount of high quality sand and gravel within the United Counties of Prescott and Russell. The material is generally found in ancient beach ridges, although there is one partially buried ice-contact deposit east of Hawkesbury.

The largest deposit is the ancient beach ridge southwest of Vankleek Hill. Extraction activities have utilized extensive amounts of the available material. Testing indicates that 1,624,000 cubic metres of '1a' and '3b' material remain.

There are three other ancient beach ridges southeast of Vankleek Hill. The material has been utilized extensively, but appreciable reserves of high quality sand and gravel remain. Testing indicates that 1,367,000 cubic metres of '1a', '2a', '3a', and '3b' material remain.

The only other significant sand and gravel deposit in West Hawkesbury is the partially buried ice-contact deposit east of Hawkesbury. Field investigation found that the material has been buried by marine silt, sand, and clay. Testing indicates that 678,000 cubic metres of '3a' and '3b' material remain.

Ministry of Natural Resources Abbreviations

MATERIAL ABBREVIATIONS

Top Soil	tpsl
Clay	clay
Silt	silt
Medium Sand	msnd
Fine Sand	fsnd
Coarse Sand	csnd
Gravel	grvl
Stones	stns
Boulders	bldr
Till	till
Bedrock	bdrk
Watertable	wt
Refusal	rfsl

UNITED COUNTIES OF PRESCOTT - RUSSELL

Bore Hole Number	Material (Depth in metres)
*BH# 1	tpsl 0.3 , grvl bldr 1.8 , grvl 4.9 , bldrs 5.2
BH# 2	fsnd 2.4 , fmsnd 3.7 , msnd 7.6

*MNR testing
Locations shown on Map

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A P P E N D I X

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Deposit Classifications for United Counties

ALFRED TOWNSHIP

Nature-Location of Deposit	Area of Deposit	Low Grade Area	Sterilized Area	Extracted Area	Depth	Volume in Cubic Metres
-Sands west of Alfred	1591.85ha	1591.86 ha	--	--	--	--
-Sands 1.6 km west of Alfred Station	154.8 ha	154.8 ha	--	--	--	--
NOTE: Measurements are in Metric Units.						

CALEDONIA TOWNSHIP

Nature-Location of Deposit	Area of Deposit	Low Grade Area	Sterilized Area	Extracted Area	Depth	Volume in Cubic Metres
-Ridge 1.2 km north of McAlpine	10.836 ha	3.612 ha	1.395 ha	2.58 ha	2 - 3.5	97,000
-Deltaic - Riceville area	1,135 ha	1,135 ha	--	--	--	--
NOTE: Measurements are in Metric Units.						

EAST HAWKESBURY TOWNSHIP

Nature-Location of Deposit	Area of Deposit	Low Grade Area	Sterilized Area	Extracted Area	Depth	Volume in Cubic Metres
-Ridge running through Ste. Anne de Prescott	26.058 ha	12.642 ha	9.80+ ha	--	--	--
-Ridge 4.8 km south of Barb	11.094 ha	0	2.0925 ha	5.676	1.5 - 48	122,000
-Delta below Chute-a-Blondeau	1132.62 ha	1132.62 ha	--	--	--	--
-West end of Carillon Park	6.966 ha	0	5.16	1.806	--	--
-West end of Carillon along access road	7.998 ha	0	7.998 ha	0	--	--
-North end of park along Ottawa R.	2.838 ha	0	2.838 ha	0	--	--
-Junction of Carillon Pk. roads	5.16 ha	0	5.16 ha	0	--	--
-East end of Carillon access road	16.77 ha	0	10.578 ha	6.192 ha	--	--
-0.8 km south of Point Fortune	10.32 ha	0		5.16 ha	2 - 3.8	181,000
-At Quebec-Ontario border just above Hwy. 417	6.45 ha	0		6.45 ha	--	--
-0.40 km north of Hwy. 417 (south of Carillon Park)	2.838 ha	0	0	2.838 ha	--	--
-Ridge 1.6 km east of Hawkesbury	46.956 ha	26.058 ha	0	6.45 ha	2 - 14	722,000
-Ridge 4.0 km south of Ste. Anne de Prescott	6.966 ha	6.966 ha	0	0	--	--

NOTE: Measurements are in Metric Units.

LONGUEUIL TOWNSHIP

Nature-Location of Deposit	Area of Deposit	Low Grade Area	Sterilized Area	Extracted Area	Depth	Volume in Cubic Metres
-deposit south of L'Orignal -						
deltaic & channel fillings	687.8125ha	609.5052 ha	3.23	12.92	1 - 3.5	1,243,000
-ridge 1.2 km north of McAlpine	2.838 ha	0.774 ha	0.6975 ha	0	2 - 4	34,000
-ridge 1.2 km southwest of Henrys Corners	3.612 ha	0	0.6975 ha	--	2 - 4	87,000

NOTE: Measurements are in Metric Units.

NORTH PLANTAGENET TOWNSHIP

Nature-Location of Deposit	Area of Deposit	Low Grade Area	Sterilized Area	Extracted Area	Depth	Volume in Cubic Metres
-Sands east of Plantagenet	1344.18ha	1344.18 ha	--	--	--	--
-Sands 1.6 km west of Plantagenet	102.684ha	102.684 ha	--	--	--	--
-Sand Deposit 4.0 km south of Wendover	872.04 ha	872.04 ha	--	--	--	--
-Sand 3.2 km east of St. Pascal	144.48 ha	144.48 ha	--	--	--	--
-Sand deposit 2.4 km north of Pendleton	2838 ha	2838 ha	--	--	--	--
-The Rollway	8.0729 ha	--	--	--	2 - 5	330,000

NOTE: Measurements are in Metric Units.

SOUTH PLANTAGENET TOWNSHIP

Nature-Location of Deposit	Area of Deposit	Low Grade Area	Sterilized Area	Extracted Area	Depth	Volume in Cubic Metres
-Sand Deposit 2.4 km north of Pendleton	175.44 ha	175.44 ha	--	--	--	--
-Delta, south portion of township	4,601 ha	4,601 ha	--	--	--	--

NOTE: Measurements are in Metric Units.

WEST HAWKESBURY TOWNSHIP

Nature-Location of Deposit	Area of Deposit	Low Grade Area	Sterilized Area	Extracted Area	Depth	Volume in Cubic Metres
-Ridge through Vankleek Hill	366.36 ha	178.02 ha	66.35 ha	75,594 ha	1 - 4.5	1,624,000
-Ridge 1.6 km southeast of Vankleek Hill	23.736 ha	0	1.215 ha	11.352 ha	3 - 6.4	558,000
-Ridge 2.0 km east-southeast of Vankleek Hill	103.2 ha	74.82 ha	0	13.674 ha	3 - 5.5	673,000
-Ridge 3.2 km south of Vankleek Hill	10.062 ha	0	5.16 ha	0.774 ha	1 - 4.5	136,000
-Ridge 1.6 km east of Hawkesbury	92.83 ha	30.96 ha	6.192 ha	21.672 ha	3 -10.5	678,000
-Ridge 1.2 km southwest of Henrys Corners	5.16 ha	0	0.6975	2.58 ha	2 - 3.5	47,000
-Delta on Longueuil/West Hawkesbury Border	34.6	34.6	--	--	--	--

NOTE: Measurements are in Metric Units.

CAMBRIDGE TOWNSHIP (RUSSELL CO.)

Nature-Location of Deposit	Area of Deposit	Low Grade Area	Sterilized Area	Extracted Area	Depth	Volume in Cubic Metres
-Deposit 2.8 km east of Casselman (North of Hwy. 417)	26.445 ha	0	1.7438 ha	11.868 ha	1 - 8.5	513,000
-Deposit 1.9 km southeast of Casselman (South of Hwy. 417)	25.9548ha	0	5.58 ha	14.706	1 - 8.5	227,000
-Delta, north portion of township	4,814 ha	4,814 ha	--	--	--	--

NOTE: Measurements are in Metric Units.

CLARENCE TOWNSHIP (RUSSELL CO.)

Nature-Location of Deposit	Area of Deposit	Low Grade Area	Sterilized Area	Extracted Area	Depth	Volume in Cubic Metres
-Sand Deposit west of Clarence Cr	5410.26ha	5410.26 ha	--	--	--	--
-Sand Deposit 4.8 km east of Clarence Creek	694.02 ha	694.02 ha	--	--	--	--
-Sand Deposit 4.0 km northeast of Clarence Creek	10.578 ha	10.578 ha	--	--	--	--
-Sand Deposit north of Orient (just south of Hwy. 17)	931.38 ha	931.38 ha	--	--	--	--
-Deposit at Rockland	163.1 ha	163.1 ha	--	--	--	--
-Deposit southeast of Rockland, Conc. V, Lot 2	11.625 ha	--	--	6.5	1 - 5M	146,000
-Delta, southern portion of twp.	3,193	3.193	--	--	--	--

NOTE: Measurements are in Metric Units.

RUSSELL TOWNSHIP (RUSSELL CO.)

Nature-Location of Deposit	Area of Deposit	Low Grade Area	Sterilized Area	Extracted Area	Depth	Volume in Cubic Metres
-Deposit 3.2 km west of Felton	26.0322ha	0	7.4355 ha	1.032 ha	1 - 3.5	527,000
-Deposit 4.8 km west of Felton	25.8 ha	0	3.645 ha	4.902 ha	1 - 3	345,000
-Deposit 1.2 km east of Felton	348.2 ha	348.3 ha	--	--	--	--
-Deposit 3.2 km southwest of Russell	8.256 ha	8.256 ha	--	--	--	--
-Deposit at North Russell	19.866 ha	19.866 ha	--	--	--	--
-Morewood Esker	12.59 ha	--	--	--	10M	755,000
-Delta, northeast side	1,304 ha	1,304 ha	--	--	--	--
NOTE: Measurements are in Metric Units.						

MAPS
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